3) $C_6H_5NH_2 + H_2O \rightleftharpoons C_6H_5NH_3^+ + OH^-$

	$C_6H_5NH_2$	$C_6H_5NH_3^+$	OH^-
I	0.10 M	0	0
C	$-x$	$+x$	$+x$
E	$0.10 - x$	x	x

$pH = 8.82 \quad \therefore pOH = 14 - 8.82 = 5.18$

$\therefore [OH^-] = 10^{-5.18} = 6.61 \times 10^{-6}$ M

$K_b = \frac{[OH^-][C_6H_5NH_3^+]}{[C_6H_5NH_2]} = \frac{(6.61 \times 10^{-6})^2}{(0.10 - 6.61 \times 10^{-6})} = 4.4 \times 10^{-10}$

(8.3)

4) $HF + H_2O \rightleftharpoons H_3O^+ + F^-$

	HF	H_3O^+	F^-
I	0.94	0	0
C	$-x$	$+x$	$+x$
E	$(0.94 - x)$	x	x

Check: $\frac{0.94}{7.2 \times 10^{-4}} > 1000$ ✓ use approximation method.

$\therefore 0.94 - x \simeq 0.94$

$K_a = \frac{[H_3O^+][F^-]}{[HF]} \quad \therefore 7.2 \times 10^{-4} = \frac{x^2}{0.94}$

to find pH, we need $[H_3O^+]$ $\quad x = 2.60 \times 10^{-2}$ M

$[H_3O^+] = x$ (check ICE chart)

$pH = -\log(2.60 \times 10^{-2}) = 1.58$

5) $Mg(OH)_{2(s)} \rightarrow Mg^{2+}_{(aq)} + 2OH^-_{(aq)}$

	$Mg(OH)_2$	Mg^{2+}	OH^-
I		0	0
C		$+x$	$+2x$
E		x	$2x$

$K_{sp} = [Mg^{2+}][OH^-]^2 = (x)(2x)^2 = x \cdot 4x^2 = 4x^3$

solubility x = mol/L

$\frac{7.6 \text{ mg}}{L} \times \frac{10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ mol}}{58.3 \text{ g}} = 1.30 \times 10^{-4}$ mol/L

$K_{sp} = 4(1.30 \times 10^{-4})^3 = 8.9 \times 10^{-12}$

6) a) $NaOCN_{(s)} \rightarrow Na^+_{(aq)} + OCN^-_{(aq)}$

$Na^+ \rightarrow NaOH$ SB ignore

$OCN^- \rightarrow HOCN$ WA

$OCN^- + H_2O \leftrightarrow HOCN + OH^-$

this salt is basic because OH^- is released into solution

b) $HOCN + NaOH \rightarrow H_2O + Na^+OCN^-_{(aq)}$

	HOCN	NaOH	$NaOCN_{(aq)}$
C	0.010 M	0.030 M	? 7.50×10^{-3} M
V	0.0500 L	$\frac{n}{c} = 0.0167$ L	0.0667 L total volume
n	$C \times V = 0.00050$ mol = 5.0×10^{-4} mol	5.0×10^{-4}	5.0×10^{-4}

$C = \frac{n}{V}$

weak — strong

~~$HOCN + NaOH \rightarrow H_2O + NaOCN_{(aq)}$~~

	~~HOCN~~	~~NaOH~~	$NaOCN_{(aq)}$
C	~~0.010 M~~	~~0.030 M~~	? 7.50×10^{-3} M
V	~~0.0500 L~~	~~$\frac{n}{c} = 0.0167$ L~~	0.0667 L total volume
n	~~$C \times V = 0.00050$ mol = 5.0×10^{-4} mol~~	~~5.0×10^{-4}~~	5.0×10^{-4}

Na^+OCN^- → (K_b)

$OCN^- + H_2O \rightleftharpoons HOCN + OH^-$

	OCN^-	HOCN	OH^-
I	7.5×10^{-3}	0	0
C	$-x$	$+x$	$+x$
E	$7.5 \times 10^{-3} - x$	x	x

$K_b = \frac{K_w}{K_a} = \frac{10^{-14}}{3.5 \times 10^{-4}} = 2.857 \times 10^{-11}$

Can we approximate? yes $\frac{7.5 \times 10^{-3}}{K_b} > 1000$

$2.857 \times 10^{-11} = \frac{x^2}{7.5 \times 10^{-3}}$

$x = 4.63 \times 10^{-7}$ M

pH → need $[H_3O^+]$ $\quad x = [OH^-]$

$pOH = -\log 4.63 \times 10^{-7} = 6.33$

$pH = 7.67$ at equivalence